ORIGINAL ARTICLE

Incidence and Risk Factors for Deep Venous Thrombosis and Its Impact on Outcome in Patients Admitted to Medical Critical Care

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Abstract

Objectives: This study evaluated the incidence and risk factors for deep venous thrombosis (DVT) while on thromboprophylaxis, in patients admitted to the medical intensive care unit (MICU), and to assess its impact on outcomes.

Methods: Consecutive patients admitted to the MICU underwent compression ultrasound of the jugular, axillary, femoral, and popliteal veins at admission, day 3 and 7 to screen for DVT. All patients were on pharmacological and/or mechanical thromboprophylaxis as per protocol. The primary outcome was the incidence of DVT (defined as occurrence on day 3 or 7). Secondary outcomes were death and duration of hospitalization. Risk factors for DVT were explored using bivariate and multivariable logistic regression analysis and expressed as risk ratio (RR) with 95% confidence intervals (CIs).

Results: The incidence of DVT was 17.2% (95% CI 12.0, 22.3) (n = 35/203); two-thirds were catheter associated (23/35). There was no difference in mortality between those with and without incident DVT (9/35 vs 40/168, p = 0.81). The mean (SD) duration of hospitalization was longer in the DVT group (20.1 (17) vs 12.9 (8.5) days, p = 0.007). Although day 3 INR (RR 2.1, 95% CI 0.9–5.3), age >40 years (2.1, 0.8–5.3), vasopressor use (1.0, 0.4–2.9) and SOFA score (0.9, 0.85–1.1) were associated with the development of DVT on bivariate analysis, only central venous catheters (15.97, 1.9–135.8) was independently associated with DVT on multivariable analysis.

Conclusions: Despite thromboprophylaxis, 17% of ICU patients develop DVT. The central venous catheter is the main risk factor. DVT is not associated with increased mortality in the setting of prophylaxis.

Keywords: Cohort, Deep vein thrombosis, Intensive care unit, Mortality, Thromboprophylaxis.

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Highlight

This large prospective study in a medical intensive care found that 17% of patients develop deep vein thrombosis, despite adequate anti-coagulation. While they increased hospital stay by 7 days, they did not increase mortality.

Introduction

Deep venous thrombosis (DVT) is frequent among critically ill patients; the incidence of DVT in the medical intensive care unit (MICU) has reduced from 30% before thromboprophylaxis to nearly 10% with thromboprophylaxis.[1–3] Without therapy, 20% of the silent calf DVT progress to popliteal, among whom nearly half develop pulmonary embolism (PE).[4] Mortality associated with PE is around 10%.[5]

Current protocols incorporate DVT prophylaxis as a part of standard practice for ICU patients.[6,7] Ho et al. studied 175,665 ICU patients and found that those who did not receive prophylaxis within 24-h of admission had higher ICU (7.6 vs 6.3%, p = 0.001) and hospital mortality (11.2 vs 10.6%, p = 0.003) than those who were treated with early thromboprophylaxis.[8] A Markov model suggests that increasing adherence to thromboprophylaxis by 10% could result in 16 fewer DVT and 1 less PE assuming a risk of 108 and 8 for

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Table 1: Thromboprophylaxis guidelines followed in the unit during the study period

All patients should be considered for thromboprophylaxis unless there are contraindications. The default drug would be Inj. Heparin 5,000 units S/C twice daily
As an alternative, the patients may also be started on one of the following, instead of unfractionated heparin, depending upon the physician's choice:
• Inj. Dalteparin 5000 U S/C OD (or).
• Inj. Enoxaparin 60 mg S/C OD (or).
• Inj. Fondaparinux 2.5 mg S/C OD.
In the case of the following situations where anticoagulation is not advisable, the patient is to be on thrombo-embolic deterrent (TED) stockings.
• Severe thrombocytopenia (<50,000).
• Deranged bleeding parameters (INR>1.5 or APTT >6s over the control).
• Active bleeding (from any site) or active gastroduodenal ulcer.
• Recent stroke or history of bleeding in the past 3 months.

DVT and PE per 1000 ICU patients respectively who were not on thromboprophylaxis.[9]

There are few studies on venous thrombosis in critically ill hospitalized medical patients in India[10–12] with a more recent study documenting a prevalence of 0.8% in a mixed-ICU despite clinically directed prophylaxis.[13] There are reports of the underutilization of prophylaxis in Asia and India.[14]

During the recent pandemic, guidelines for Indian ICUs suggested prophylaxis in all such patients.[15] A systematic review suggested that low molecular weight heparin (LMWH) may be the treatment of choice.[16] There is limited evidence on DVT in MICU's in India, their risk factors, outcomes. and outcome predictors.[17] This study attempts to fill these gaps in knowledge.

Methods

Setting and Study Design

This prospective observational cohort study was done between June 2013 and April 2014 in a teaching tertiary care hospital in India, at the MICU and high dependency unit (HDU). This is a 24-bed complex with 1500–1600 admissions yearly with more than two-thirds requiring mechanical ventilation and nearly 50% requiring more than 1 week of stay. The average mortality is around 25%.

Inclusion and Exclusion Criteria

Adult patients (18 years or older) admitted to the MICU/HDU under general medicine were considered for inclusion. We excluded patients if there was an admission diagnosis of DVT/PE, if patients were already on therapeutic anticoagulation, readmission to MICU/MHDU within a single hospital stay and when patient or the caregiver refused consent to participate in the study. Patients who died within 48 hours of ICU admission or who were discharged from the hospital within 48 hours of admission were also excluded from the study, post-inclusion. In patients who were transferred to the ward prior to day 3 and day 7, ultrasound screening was followed up in the wards and screened on the respective days. Those who were discharged before their day 7 ultrasound, were considered lost to follow-up for the last follow-up scan.

Protocols

All patients received thromboprophylaxis based on the protocol that was in place in the unit at the time of study (Table 1). The study investigators were not involved in the decision on thromboprophylaxis.

Sonological Assessment

M-Turbo Ultrasound machine (Sonosite) [dynamic range up to 165 dB] was the bedside ultrasound machine used for the study. Lack of compressibility and direct visualization of the thrombus were used to diagnose DVT. In the absence of compressibility, the presence of a thrombus was further confirmed with phasicity and augmentation. These techniques were used for the detection of upper limb and lower limb DVT at four points, jugular, axillary, femoral, and popliteal veins bilaterally. In the event of direct thrombus visualization, compressibility was not done because of the risk of proximal embolization. Compression ultrasound (CUS) was performed on day 1, day 3, and day 7 following admission to the MICU/MHDU. As we were looking at the incidence of DVT, we excluded patients who had a demonstrable DVT on day 1.

The thrombi were characterized as (1) *complete:* evidenced by the complete lack of compressibility of the vein or visualization of the thrombus which was causing near total luminal occlusion or absence of flow on color flow imaging, (2) *partial:* wherein there was partial luminal obstruction of the vein with partial compressibility or visualization of a thrombus partly occluding the lumen or color flow imaging showing partial flow across the lumen, and (3) *small catheter-related thrombus*: with the presence of echogenic small thrombus around the catheter.

Outcome Parameters

The primary outcome of the study was the incidence of DVT. Secondary outcomes included all-cause and cause specific hospital mortality, ICU mortality, and length of ICU and hospital stay. We studied known risk factors for the development of DVT. All in-hospital deaths were categorized as (1) sudden death where the cause was uncertain (PE may be considered as one of the differentials), (2) confirmed PE (by imaging – RA/RV dilatation on ECHO or CT pulmonary angiogram (PA)-based diagnosis), or (3) causes other than PE. We also documented discharge against medical advice and a discharge diagnosis of DVT.

Statistical Aspects

The sample size was estimated to be 196 with the presumed incidence of DVT of 15%[18] among patients admitted in the MICU, with confidence intervals (CIs) of 95% and margin of error of 5%. As we planned multivariable analysis for risk factors for DVT including mechanical ventilation and central venous catheters,[19] sample size was also calculated for this which was 88, and was lower than the 196 planned and hence was considered adequate.

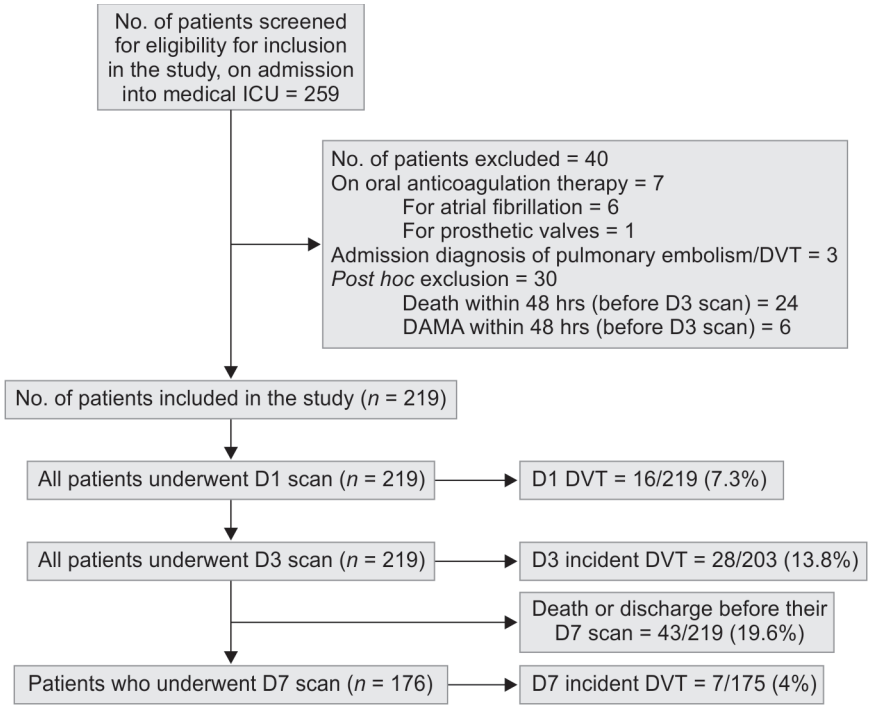

Fig. 1: STROBE figure-flow of patients in the study

The principal investigator (AK) was trained over a period of 2 weeks in CUS for the detection of DVT by (KP) an intensivist with training and experience in point of care ultrasound (POCUS) in critical care to reduce detection bias. Reliability exercise was done on 48 patients to determine the inter-observer agreement between the PI who was a resident in internal medicine at the time and ICU POCUS experts (AK, TI, and a radiologist prior to initiation of the study). The overall interrater reliability (kappa 0.77) was good.

Data were entered in EPIDATA 3.1 software and analysis was done using SPSS for Windows, Version 16.0. Chicago, SPSS Inc. Categorical variables were analyzed using the Chi-square test with Yates's correction and Proportion test. Continuous variables were analyzed using the independent sample *t*-test. Non-parametric Mann–Whitney *U* test was used when the distribution was skewed. Logistic regression analysis was done to determine the risk factors for DVT with log link. Model assumptions were checked using deviance residual plots against predicted probability.

Ethical Aspects

The protocol was approved by the Institutional Review Board and Ethics Committee (No: 8067).

Results

Of the 259 patients potentially eligible, 219 were included (Fig. 1). The mean, standard deviation (SD) age was 45.3 (17.5) years and 55% (121/219) were men (Table 2); the mean SOFA score at admission was 7.2 (4.2). The risk factors for DVT that were identified were prior hospitalization (17.8%), smoking (15.5%), and alcohol intake (21.5%). Effect modifiers were treatment with vitamin K, aspirin, and clopidogrel in 16.4, 11.4, and 8.7%, respectively. Only 10 (3.9%) patients had symptoms suggestive of DVT which included swelling (*n* = 5), warmth (*n* = 3), erythema (*n* = 1) and tenderness (*n* = 1). One-hundred sixty-four patients (74.9%) were on mechanical

Table 2: Baseline characteristics of the study cohort

Variable	*Value (n = 219)*
Age, mean (SD) years	45.3 (17.5)
Gender male (%)	121 (51.3)
Past history	
Surgery within 4 weeks of admission	14 (6.4)
Trauma within 4 weeks of admission	4 (1.8)
Hospitalization within 3 days	39 (17.8)
Previous deep vein thrombosis	0
Previous central venous catheter	4 (1.8)
Non-steroidal anti-inflammatory use	2 (0.9)
Rheumatic/autoimmune disease	15 (6.8)
Present history	
Congestive cardiac failure	9 (4.1)
Chronic liver disease	7 (3.2)
Chronic kidney disease	14 (6.4)
Malignancy	1 (0.5)
Pregnancy	0
Postpartum	7 (3.2)
Chronic immobilization (stroke/paresis)	7 (3.2)
Pacemaker insertion	4 (1.8)
Smoking	34 (15.5)
Alcohol use	47 (21.5)
Aspirin use	2 5 (11.4)
Clopidogrel use	19 (8.7)
Vitamin K supplements	36 (16.4)
Other comorbidities	104 (47.5)
SOFA score at admission (mean (SD)	7.2 (4.2)

(Contd...)

Table 2: *(Contd...)*

Variable	*Value (n = 219)*
Symptoms suggestive of deep vein thrombosis	10 (4.7)
Erythema	1 (0.5)
Warmth	3 (1.4)
Tenderness	1 (0.5)
Swelling	5 (2.3)
Thromboprophylaxis	219 (100)
Pharmacological	122 (55.7)
Unfractionated heparin	116/122 (95.1)
Low molecular weight heparin	6/122 (4.9)
Mechanical prophylaxis (compression stockings)	92 (42)
Both pharmacological and mechanical	5 (2.3)

Values in parentheses indicate percentage unless specified otherwise. SOFA, sequential organ failure assessment score

ventilation and 154 (70.2%) had central venous catheters; femoral (47.4%) and jugular (48.7%), respectively. All patients were on thromboprophylaxis (Table 2).

Primary Outcome

On day 1 of ultrasound screening, 16 patients had DVT (7.3%); of these, 87% were femoral and 13% jugular. The day 3 follow-up scan picked up an additional 28 patients with DVT among the 203 patients (13.8%) remaining patients at risk. Of the 219 patients, the day 7 scan was not done in 43 patients due to death or discharge within a week of ICU admission. Among the remaining 175 patients at risk, 7 additional patients had DVT on day 7 of ICU admission (4%).

The incidence of DVT in our cohort was 17.2% ($n = 35/203$; 95% CI 12.0, 22.3), of which two-thirds were catheter-related; 68, 23, 6, 3%, respectively were femoral, jugular, multiple, and popliteal. Three-fourths of our DVTs were from the lower limb (all but one being femoral thrombi). The incidence of non-catheter-related DVTs was 5.9% (95% CI 2.6, 9.1).

Among the 17 patients who had DVT on day 1 (unilateral in 16 patients, bilateral femoral DVT in one patient), 40% had complete thrombosis; the 2 patients who had jugular thrombi had small catheter-related thrombi. The remaining 15 patients had femoral thrombi; 8 of them had catheter-related thrombi. Nearly, half of these DVTs resolved by 3 days (first follow-up scan) and three-fourth by 7 days. Among the 30 patients who had DVT on day 3, 13 (43.3%) were catheter-related thrombi (jugular 7, femoral 6). Of the remaining patients, 9 patients had partial thrombosis of the femoral ($n = 7$) or femoral ($n = 2$) veins and 8 patients had complete thrombosis of the jugular ($n = 1$) or femoral ($n = 7$) veins). Day 7 thrombi ($n = 7$) included catheter-related thrombi in 3 patients, and partial and complete thrombus in 2 patients each.

The results of a positive scan were conveyed to the treating physicians. Only 3/35 (8.57%) were discharged with a diagnosis of DVT and were on oral anticoagulation; 2 detected on day 3 and 1 on day 7; 1 had bilateral femoral thrombi, 2 had jugular and femoral thrombi. In those who were detected to have DVT on day 3 scan, by day 7 scan nearly half had spontaneously resolved (Fig. 2).

Secondary Outcomes

The in-hospital mortality rate was 24.7% ($n = 54/219$); of these 77.8% (42/54) died in the ICU and 9 (16.7%) were sudden deaths. Fourteen patients were discharged against medical advice (14/219, 8.7%). The mean (SD) duration of ICU stay was 7.2 (5.3) and that of hospitalization was 14.6 (11.4).

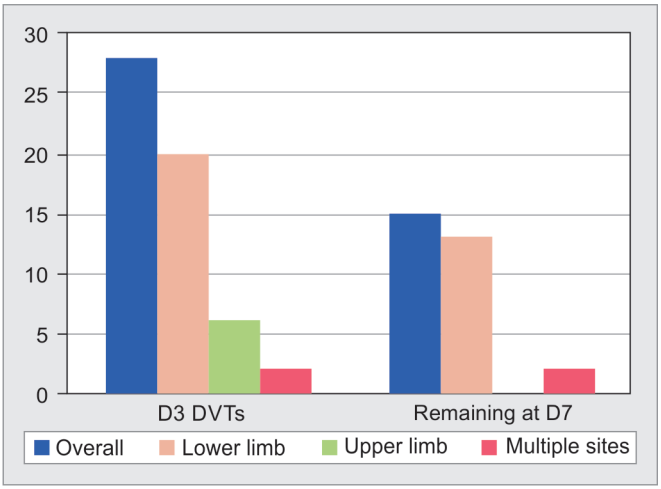

Fig. 2: Course of day 3 deep vein thrombosis

Table 3: Multivariable analysis for risk factor incident DVT in the study cohort

Risk factor	*Relative risk*	*95% Confidence interval*	*p-value*
Central venous catheter	15.9	1.88, 135.8	0.01
Day 3 INR	2.16	0.87, 5.34	0.09
Age more than 40 years	2.05	0.79, 5.34	0.14
Vasopressor use	1.01	0.36, 2.88	0/93
SOFA score	0.95	0.85, 1.06	0.34

Nagelkerke *R*-square 0.209. Hosmer–Lemeshow test value 0.347; INR, International normalized ratio; SOFA, sequential organ failure assessment

Exploratory Analyses

The median duration of hospital stay was higher in the DVT group (20.5 days) when compared with the non-DVT patients (10.5 days) ($p < 0.001$) ICU stay was also longer. The mean duration of ICU stay at the development of DVT was 3.8 **(**1.6) days, while from the day of hospital admission this was 7.2 (6.7) days.

Among the 9 sudden deaths there was no difference in the incidence of sudden deaths between those with DVT and those with no DVT; one (1/9) patient with femoral and jugular thromboses was clinically suspected to have died due to PE. Among those with DVT, 61% were alive at discharge, 10% were discharged against medical advice and 29% of them died. Among those who died, 21% had sudden death while 79% of the patients had other known causes.

Comparing non-catheter and catheter-related DVT, the mean duration of hospital stay (29.2 vs 19.8 days) and the mean duration of hospitalization at the time of development of DVT (9.3 vs 6.1 days) were non-significantly longer in the non-catheter-related DVT group.

Risk Factor Analysis

Day 1 DVTs were excluded from the risk factor analysis. The results of the bivariate showed that central venous catheter, femoral-dialysis port, duration of central venous catheters, age more than 40 years, vasopressors, day 3 PT and INR to be significantly associated with the development of DVT. On multivariate logistic regression analysis (Table 3) (including SOFA score to adjust for severity), central venous catheters (RR 15.87; 95% CI 1.88, 135.8) emerged as the sole independent risk factor.

Table 4: Multivariable analysis for risk factor in-hospital mortality in the study cohort

Risk factor	*Relative risk*	*95% Confidence interval*	*p-value*
Mechanical ventilation	6.31	1.22, 32.6	0.028
Vasopressors	2.28	0.72, 7.2	0.16
Transfusions	2.18	0.75, 6.38	0.15
Sedatives	1.47	0.54, 4.02	0.45
Central venous catheters	1.32	0.36, 4.84	0.68
Age more than 40 years	1.13	0.51, 2.54	0.77
SOFA score	1.07	0.97, 1.19	0.18
Day 3 APTT	1.05	1.002, 1.09	0.04
Day 3 INR	0.64	0.19, 1.46	0.22
Pharmacological thromboprophylaxis	0.58	0.04, 7.75	0.68
Mechanical thromboprophylaxis	0.65	0.05, 9.1	0.75

Nagelkerke *R*-square 0.301. Hosmer–Lemeshow test value 0.132; APTT, activated partial thromboplastin time; INR, International normalized ratio; SOFA, sequential organ failure assessment

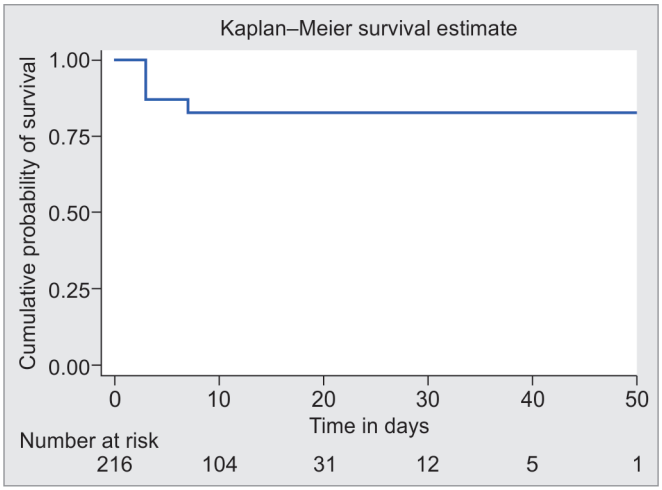

Fig. 3: Probability of DVT free survival in the unit

When the factors associated with in-hospital mortality were explored, on multivariable analysis (Table 4), only mechanical ventilation (RR 6.31; 1.22, 32.58) and day 3 APTT (RR; 1.05, 1.002, 1.092) were independent predictors for in-hospital mortality.

The overall probability of DVT-free survival came down as the duration of the ICU stay increased, with the steepest drop being observed at around day 3 of ICU stay (Fig. 3). The mean duration of ICU stay at DVT development was 3.8 (1.6) days.

Discussion

The incidence of DVT in our cohort was 17.2% during the first 7 days of ICU admission. Nearly, three-fourths were proximal lower limb DVTs, and two-thirds were catheter-related, a majority of which resolved in a week. Among those with incident DVT, only 8.6% were discharged on anticoagulation. Central venous catheter was an independent risk factor for the development of DVT. The duration of hospitalization was significantly higher in those with DVT. Overall morality was 24.7% and not different between those with and without DVT. The need for mechanical ventilation and day 3 APTT were independently associated with in-hospital mortality.

Comparison with Indian Data

A study from south India found an incidence of 7.46 DVT per 10,000 hospital admissions, 93% lower limb, and two-thirds proximal.[20] Venous thromboprophylaxis was given in 47 and 45% of medical and surgical patients, respectively in mixed-ICU.[21] On the other hand, in a study from Delhi in the general ward and ICU, the incidence was only 3% incidence despite none being on thromboprophylaxis.[11] Another study showed that the clinical signs and symptoms of DVT were present in 25.8% of patients in the medical wards/MICU; although 75% of patients had been at high risk for developing DVT at the time of admission, only 12.5% had been on thromboprophylaxis.[10] Among geriatric patients in general wards/ICU in Mumbai 13.5% had incident DVT by ultrasound Doppler; only 2.7% were clinically evident; among those in the ICU 42% were on thromboprophylaxis.[22] In a mixed MICU/surgical ICU (SICU), the incidence of DVT was 13.8% with the incidence being 8.3% among those on thromboprophylaxis and 25% among those without thromboprophylaxis.[23] In a Chennai ICU, the incidence of DVT was 6.6% in the absence of thromboprophylaxis, with no pulmonary emboli;[17] only a single ultrasound Doppler done in this study.

Comparison with Global Data

In a Boston ICU, with 61% on thromboprophylaxis, the incidence of DVT was 33%.[1] A Chinese study reported the incidence of DVT to be 19% in the ICU in the absence of thromboprophylaxis.[24] Another study found the incidence of DVT at 15.1%, thromboprophylaxis status not being clear.[18] A Thai study found the incidence of DVT was 8.82% despite thromboprophylaxis not being complete.[25] A study from Iran found the incidence of DVT to be 5.2%; thromboprophylaxis status not clear.[26] In a Canadian study in the MICU/SICU, 5.4% developed DVT, with two-thirds being covered with thromboprophylaxis; however, ultrasound was used to diagnose DVT only in those with a high index of clinical suspicion.[27] In critically ill trauma patients, 13% developed DVT despite adequate thromboprophylaxis,[28] similar to a Massachusetts ICU incidence of proximal lower limb DVT of 12% with 92% thromboprophylaxis coverage.[29] However, a study of ICU patients requiring prolonged care found a DVT incidence of 23.6% despite all of them being on thromboprophylaxis.[30]

The above studies show a wide variation in the incidence of DVT both in the Indian context and globally; the reported variation in the studies is probably related to several factors such as the type of patients, severity of illness, and whether they were on thromboprophylaxis or not. The incidence of DVT in our cohort of 17.4%, is around mid-way in the incidences reported in the studies. One reason for the relatively high incidence of DVT in our cohort despite thromboprophylaxis could be the diagnosis of transient thrombi related to central venous catheters, that resolved within a week and the frequent and regular ultrasound surveillance within the first week of ICU stay. Catheter-related DVTs contributed to two-thirds of the incident DVTs in our study. The presence of a catheter, which causes direct endothelial injury and thereby directly activating the procoagulant cascade, could have played a role in the development of DVT. We also screened for upper extremity thrombi; most of the studies cited above have described only the presence of proximal lower limb DVT.[31] Both PE and thromboembolic pulmonary hypertension can occur in patients with upper extremity thrombi as well.[32,33]

The PROTECT trial showed that despite 100% pharmacological thromboprophylaxis, the incidence of proximal lower limb DVT was 5.4%.[34] This incidence is lower compared with 11.8% in our cohort wherein pharmacological thromboprophylaxis could be given only in 58% of patients. The remaining were on mechanical prophylaxis. The incidence of non-leg DVT was 2.2% in the PROTECT study[33] while it was 3.9% in our study.

In the Boston study,[1] the majority of DVTs were from the proximal lower limb, and nearly two-thirds were associated with the presence of a central venous catheter; which was similar to the observations in our study. Upper extremity thrombi were contributed solely by the jugular involvement, similar to another study where majority of upper extremity thrombi were in the internal jugular.[32]

Seventy percent of DVTs in the Boston study were detected within the first 5 days of ICU stay. The Chinese study[24] showed that most of the DVTs in the intensive care setting occurred at day 3, similar to our observations. In our study, it was seen that the probability of DVT-free survival dropping after day 3 of ICU stay. This study also showed that many DVTs in their MICU were asymptomatic, with only 27% being symptomatic. This was similar to an Indian study where all the DVTs had been asymptomatic.[11] In our study, it was seen that only 5.7% of the DVTs were symptomatic.

The catheter-related DVTs contributed to 40.5% of the incident proximal lower limb DVTs and 51% of the non-leg DVT in the PROTECT trial.[33,34] The frequency of catheter-related thrombi was higher in our study, 64.7% proximal lower and 80% upper extremity.

In the Boston study, 21% with DVT required therapeutic intervention (IVC filters 9% and initiation of oral anticoagulation in 12%).[1] In contrast, only 8.5% of patients with DVT required oral anticoagulation in our cohort. A few studies have shown that the presence of DVT increases the duration of ICU stay and hospitalization.[28,33,34]

Clinically important DVTs that may cause short-term or long-term morbidity or mortality are associated with leg symptoms, clinical suspicion of PE, poor cardiopulmonary reserve as a result of co-morbid conditions, proximal site, large size, and total occlusion of the venous lumen by the thrombus.[35] In our study, leg symptoms were seen in 10 patients of whom only two developed proximal lower limb DVT. Although there were no cases of confirmed PE in our study, there were 9 sudden deaths, one-third happened in the DVT group. Among these sudden deaths, there was a clinical suspicion of PE in only one patient. There was no difference in mortality among those with and without DVT in our study. Most of the patients had poor cardiopulmonary reserve, given the overall requirement of mechanical ventilation and vasopressors being 75% and 54%, respectively.

Among hospitalized patients with a diagnosis of DVT, malignancy, and surgery were the important risk factors for DVT.[20] Older age, prolonged bed rest (among medically ill patients), surgery and central venous catheters (among surgical patients) were risk factors in one study.[21] A study in a mixed-ICU, femoral venous catheters, mechanical ventilation, sedatives, and paralytic agents were risk factors. Thromboprophylaxis and warfarin were found to be protective.[27] A Thai study identified older age, central venous catheters, female gender, and renal replacement therapy to be risk factors.[25] The Boston study found predictor of upper extremity catheter-related DVT was the presence of a central venous catheters.[31]

Therefore, the common risk factors echoed through most of the afore-mentioned studies include the presence of central venous catheters (CVC) and older age of the patient. Perhaps, CVC should be used with discretion. The duration of the CVC was also found to influence the development of DVT.

Limitations

The study protocol included three consecutive ultrasound screening scans on days 1, 3, and 7 from the time of admission into the MICU. Repeat screening ultrasound scans after day 7 could not be done due to feasibility constraints. This study was restricted to the patients belonging to internal medicine departments; other medical subspecialities were not represented. Although the duration of CVC was known in all the patients, a repeat Doppler scan following removal of in patients with catheter-related DVT would have been ideal, this was not done due to feasibility constraints.

Merits

Regular CUS helped detect several asymptomatic DVTs. This was helpful as our study helped to delineate the timeframe for the development of DVTs and their course in the medical intensive care setting. The results of our study will be applicable to patients in other medical ICUs. As this study was done in a hospital where the ICUs are well integrated with the medical wards, the follow-up was complete.

Conclusions

In our study cohort of internal medicine patients admitted to critical care, the incidence of DVT was 17.2% while on standard thromboprophylaxis. The incidence of non-catheter-related DVT was 5.9%. Only 13.6% of those with DVTs who were discharged, required to be started on oral anticoagulation therapy. The majority of the DVTs, especially the catheter-related ones, had a favorable course. The presence of DVT was associated with an increase in the median duration of hospital stay by 10 days. The presence of CVC was an independent risk factor for the development of DVT. This risk was higher in the older patients. Based on this study, we recommend simple thromboprophylaxis for all MICU patients. We also suggest periodic Doppler surveillance for DVT and appropriate/timely removal of CVC.

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